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| APPLICATION NO.            | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|----------------------------|-------------|----------------------|---------------------|------------------|
| 10/766,031                 | 01/29/2004  | Masayuki Hata        | 57810-085           | 1109             |
| 20277                      | 7590        | 11/16/2005           | EXAMINER            |                  |
| MCDERMOTT WILL & EMERY LLP |             |                      | RICHARDS, N DREW    |                  |
| 600 13TH STREET, N.W.      |             |                      | ART UNIT            |                  |
| WASHINGTON, DC 20005-3096  |             |                      | PAPER NUMBER        |                  |
|                            |             |                      | 2815                |                  |

DATE MAILED: 11/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/766,031

Applicant(s)

HATA ET AL.

Examiner

N. Drew Richards

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 30 August 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-4 and 6-29 is/are pending in the application.
- 4a) Of the above claim(s) 27-29 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 9-12, 18-20, 24-26 is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-8, 13-17 and 21 is/are rejected.
- 7) ☒ Claim(s) 22 and 23 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Claim Objections***

1. Claim 4 is objected to because of the following informalities: the limitation on lines 13-14 reciting a region of the back surface having said concentrated dislocations on at least part of the back surface thereof should be moved so that it is recited before the limitation of lines 10-12 reciting a back electrode in contact with a region of the back surface other than the region with the concentrated dislocations. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 6-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 6-8 depend from cancelled claim 5. Since they depend from a cancelled claim, these claims are indefinite as one of ordinary skill cannot ascertain the metes and bounds of the claims.

4. Insofar as definite the claims are rejected as follows. For the sake of the art rejections below, claims 6-8 are interpreted as depending from claim 4.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-4, 6-8 and 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Takatani et al. (U.S. Patent No. 6,812,496 B2).

With regard to claim 1, Takatani et al. disclose in figure 5, a device comprising:

- a substrate 100 provided with a region of the back surface having concentrated dislocations X1 at least on part of the back surface thereof;
- a semiconductor element layer (layers above 100 and below 116) formed on the front surface of the substrate 100;
- an insulator layer 115 (unlabeled in figure 5, see figure 4 for label) formed on the region of the back surface having concentrated dislocations X1;
- a back electrode 117 formed to be in contact with a region of the back surface of the substrate other than the region of the back surface having concentrated dislocations X1, wherein the back electrode is transparent (though not explicitly stated, it is nonetheless an inherent property of the materials taught for the back n-type electrode that they are transparent to at least one wavelength of

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electromagnetic radiation, for instance high energy cosmic or gamma rays, see column 14 lines 42-44 for materials disclosed).

With regard to claim 2, Takatani further disclose:

- the semiconductor element layer is provided with a region of the front surface having concentrated dislocations X1 at least on a part of the front surface;
- the semiconductor device further comprising a front electrode 116 formed to be in contact with a region of the front surface of the semiconductor element layer other than the region of the concentrated dislocations X1.

With regard to claim 3, the substrate is a nitride-based semiconductor substrate.

With regard to claim 4, Takatani et al. disclose in figures 5 or 12:

- a semiconductor element layer (layers above 100 and below 116) formed on the front surface of the substrate 100 and provided with a region of the front surface having concentrated dislocations X1 at least on a part of the front surface;
- an insulator film (115 in figure 5 or 122 in figure 12) formed on the region of concentrated dislocations X1;
- a front electrode 116 formed to be in contact with a region of the front surface of the element layer other than the region having the concentrated dislocations; and

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- a back electrode 117 formed to be in contact with a region of the back surface of the substrate other than the region of the back surface having the concentrated dislocations, wherein
- the substrate is provided with a region of the back surface having the concentrated dislocations X1 on at least a part of the back surface thereof; and
- the back electrode is a transparent electrode (though not explicitly stated, it is nonetheless an inherent property of the materials taught for the back n-type electrode that they are transparent to at least one wavelength of electromagnetic radiation, for instance high energy cosmic or gamma rays, see column 14 lines 42-44 for materials disclosed).

With regard to claim 6, the substrate is a nitride-based semiconductor substrate.

With regard to claim 7, as seen in figure 12 the back electrode is provided inwardly spaced from the side of the substrate by a prescribed interval.

With regard to claim 8, as seen in figure 5, an insulator film 15 is formed on the back surface on the region of the concentrated dislocations.

With regard to claim 21, Takatani et al. disclose in figure 5:

- a substrate (layers 100-109) including a first region having a first thickness (central portion where 109 is thicker) and a second region provided with a region of concentrated dislocations X1 on the front surface thereof while having a

second thickness smaller than the first thickness (the edge portions have a smaller thickness);

- a semiconductor element layer (110 and 111 above 109 in the central region, for labels see figure 1) formed on the first region of the front surface of the substrate other than the second region; and
- a front electrode 116 formed to be in contact with the front surface of the element layer (110 and 111).

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takatani et al. as applied above in view of Wilmsen et al. (Vertical-Cavity Surface-Emitting Lasers, Pp. 4 and 7).

With regard to claim 13, Takatani et al. teach in figure 5:

- a semiconductor element layer 109 (and unlabeled central layers above) formed on the front surface of a substrate 100 and provided with a region of the front surface having concentrated dislocations X1 at least on part of the front surface; and

- a front electrode 116 formed to be in contact with a region of the element layer other than the region of the concentrated dislocations X1.

Takatani et al. do not teach a high resistance region formed in the region of the front surface having the concentrated dislocations wherein the high resistance region is formed separately from the dislocations in order that electric current is difficult to flow through the region having the concentrated dislocations by the high resistance region.

Wilmsen et al. teach various laser structures in figure 1.4. Specifically in figure 1.4(b) Wilmsen teach a high resistance region on either side of a central semiconductor element layer so as to confine the current in the semiconductor element layer to a smaller central area. Wilmsen teach the high resistance region being proton doped. At the time of the invention, it would have been obvious to one of ordinary skill in the art to form the proton doped high resistance regions of Wilmsen et al. in the laser device of Takatani et al. in order to confine the current to allow for the formation of a VCSEL. In forming the high resistance regions of Wilmsen et al. in the device of Takatani, the high resistance region is formed separately from the dislocations (since the dislocations are formed as part of the substrate and layer growth and the high resistance region is formed by proton doping into the already formed layers) and would necessarily result in the electric current being difficult to flow through the region having the concentrated dislocations by the high resistance region.



With regard to claim 14, the high resistance region as taught by Wilmsen includes an impurity introduction layer formed by introducing the impurity (proton doping reads on introducing an impurity).

With regard to claim 15, the substrate has concentrated dislocations X1 on the back surface thereof and a back electrode 117 in contact with the back surface in a region other than the region where the concentrated dislocations are formed.

With regard to claim 16, as seen in figure 5, an insulator film 15 is formed on the back surface on the region of the concentrated dislocations.

With regard to claim 17, the substrate is a nitride-based semiconductor substrate.

#### ***Allowable Subject Matter***

9. Claims 9-12, 18-20 and 24-26 are allowed.
10. Claims 22 and 23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

#### ***Response to Arguments***

11. Applicant's arguments filed 8/30/05 have been fully considered but they are not persuasive.

With regard to claims 1 and 4, applicant has argued that Takatani et al. fail to disclose a transparent back electrode. This is not persuasive. Applicant has not

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defined in the claims or in their specification what wavelength, energy, or portion of the electromagnetic spectrum the back electrode is required to be transparent to. As one of ordinary skill in the art will recognize, the layers taught by Takatani et al. as being appropriate for their back electrode, formed to any reasonable thickness for a laser device, will inherently be transparent to at least some part of the electromagnetic spectrum and thus are "transparent" as claimed.

With regard to claim 13, applicant has argued that Takatani fails to teach a high resistance region formed separately from concentrated dislocations. This is not persuasive as the secondary reference to Wilmsen et al. has been relied upon to teach this limitation.

With regard to claim 21, applicant has argued that Takatani does not teach the substrate having a first region with a first thickness and a second region with a second thickness smaller than the first thickness. Applicant basis this argument on an improperly narrow interpretation of Takatani by limiting the "substrate" to only layer 100. This is not persuasive. The term substrate is known in the art to be used to describe or define any and all layers upon which a further process is performed or a further layer is added. In Takatani, the "substrate" has been interpreted as stated in the rejection as being layers 100-109. This is the "substrate" that layers 110-112, 115 and 116 are later formed on. This interpretation of the term "substrate" is considered to be a reasonable interpretation and thus the rejection using this interpretation is proper.

### ***Conclusion***

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to N. Drew Richards whose telephone number is (571) 272-1736. The examiner can normally be reached on Monday-Friday 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'N. Drew Richards', is positioned above the printed name.

N. Drew Richards

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